

# **U.S. Department of Agriculture Guidance on Electric Metering**

## **INTRODUCTION**

The Energy Policy Act of 2005 (EPAAct2005) increases Federal energy reduction mandates on an annual basis. To help achieve this requirement, EPAAct2005 requires agencies to measure and account for electricity consumption on a building basis through electrical metering technologies. Specifically, EPAAct2005, Section 103, requires Federal agencies to install advanced metering systems in all buildings, where found to be cost-effective, by October 1, 2012.

This document provides guidance for USDA agencies to apply, as appropriate, to their respective approaches to complying with the metering requirements of EPAAct2005. This guidance is based on USDA's *Buildings Electric Metering Plan* and overall guidance from the Federal Energy Management Program (FEMP).

## **DEPARTMENT OF AGRICULTURE'S OBJECTIVES**

The Department of Agriculture's objectives for electric metering include, but are not limited to, the following:

- Fully implement advanced electric metering at USDA buildings wherever life cycle cost effective by October 1, 2012.
- Identify the specific list of buildings (including name, location, and type) in which advanced electric metering will be implemented.
- Reduce electrical consumption by eight percent (in buildings with advanced metering systems) by end of FY 2011 through no-cost and low-cost efficiency measures identified through continuous and timely data analysis and resulting actions.
- Ensure timely analysis of metered data at all agency sites.
- Employ cost allocation and demand response or time allocation programs where possible.

## **PLANNING, ANALYSIS AND DEVELOPMENT**

In accordance with USDA's Buildings Electric Metering Plan, agencies must develop their respective metering plans by March 31, 2007. The agency metering plan should include the results of a metering infrastructure survey, a list of specific buildings in which advanced meters will be installed along with an associated inventory of meter types to be installed, and a time line of metering installations. The time line will highlight the priority of installations (buildings with the largest square footage should be metered first). The agency metering plan should also outline the financing strategy for the installation of meters. Agencies should also consider equipment specifications and the metering systems communication requirements when developing their plans. Also, it is recommended that the agency plan include a life cycle cost analysis of metering compliance. Finally, the plan must be signed by a senior agency official.

## **Criteria for Advanced Electric Metering Planning**

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Agencies are recommended to apply the criteria below for determining whether or not to install advanced electric meters in a building:

Buildings that should be included in the agency metering plan include:

- Buildings, which are greater than 10,000 gross square feet (GSF).

Buildings that may be excluded from advanced electric metering planning include:

- Non energy-intensive buildings, such as warehouses, that are greater than 10,000 GSF;
- Cases where the agency is not responsible for the utilities or energy bills (e.g., buildings with fully-serviced leases in which the agency is the tenant).

The criteria in this section should also be applied to new design/construction, as well as, major renovations.

### **PROGRAM STRUCTURE**

Agencies are recommended to follow the metering program structure detailed below in developing their metering plans. In addition, it is highly recommended that agencies thoroughly review the Department of Energy (DOE), Federal Energy Management Program's (FEMP) *Guidance for Electrical Metering in Federal Buildings* for further details and assistance.

FEMPS's guidance may be found on the Internet at

[www1.eere.energy.gov/femp/pdfs/adv\\_metering.pdf](http://www1.eere.energy.gov/femp/pdfs/adv_metering.pdf).

#### **A) Survey Existing Agency Metering Infrastructure**

Agencies will need to survey existing meters, metering systems, and metering capabilities [e.g., energy management and control system (EMCS) capabilities] in all buildings to the maximum extent practicable. Current uses and status of these metering systems should be identified. In addition, current funding allocations for metering should be outlined.

Agencies should also assess the requirements for, and availability of, staff to support on-going metering programs in all phases (i.e., operations, maintenance, and data analysis). Various options for providing support requirements should be explored (i.e., subscription services, agency centralized metering programs, dedicated on-site staff, etc.). Agencies shall determine the amount of funding required to support these functions and shall include this in the agency annual budgeting process.

#### **B) Analyze Agency Buildings for Cost-Effectiveness of Metering**

Agencies should use the results of the metering infrastructure survey and analyze the cost-effectiveness of metering buildings and the level of resource allocation necessary to monitor the data, in order to determine which buildings should have standard or advanced meters installed.

To determine cost-effectiveness, agencies need to estimate the cost to design, purchase, install, maintain, store data, operate the meter/metering system, and analyze

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the data output; and the resulting energy cost savings. The FEMP electrical metering guidance contains more detail on this type of analysis.

Metering system costs vary widely for a number of reasons: equipment specifications and capabilities, existing infrastructure, site-specific design considerations, local cost factors, etc. Therefore, it is not possible for this policy to outline a specific dollar value to use as an estimate. Agencies are responsible for obtaining industry estimates for their application and locality.

To determine the cost savings of the metering in the building, agencies should use the following table as guidance.

### Metering Savings Ranges

Action	Observed Savings
Installation of meters	0 to 2% (the “Hawthorne effect”)
Bill allocation only	2-1/2 to 5% (improved awareness)
Building tune-up	5 to 15% (improved awareness, and identification of simple O&M improvements)
Continuous Commissioning	15 to 45% (improved awareness, identify simple O&M improvements, project accomplishment, and continuing management attention)

Of course, it is necessary to estimate the annual energy costs in the building to apply the above cost savings ranges. For those buildings where an estimate cannot be made based upon historical consumption data, DOE has developed a database of typical energy usage intensity factors (EUI) (typically given in units of energy use/ft<sup>2</sup>/year). One source of commercial building EUI data is DOE’s Buildings Energy Databook available online at <http://buildingsdatabook.eren.doe.gov/>. This approach does have its limitations as a building’s energy use is driven by many site-specific variables and characteristics that may approach, but not exactly match, generalized EUI estimates.

EPAct2005 states that advanced meters shall be installed at Federal facilities “to the maximum extent practicable.” Agencies should weigh all of the factors involved with metering beyond the initial cost to purchase and install the meters. A life cycle cost (LCC) comparison of various metering options is recommended to determine the best possible metering decision. The FEMP metering guidance contains a good example of an LCC analysis on page 11 of the document.

### C) Develop Agency Metering Plan

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Agencies should develop a formal metering plan based upon the results of the metering infrastructure survey, the LCC analysis, and the technical research outlined in Section VI of this policy document. Additional guidance on developing the metering plan may be obtained from the FEMP electrical metering guidance document.

Since many agencies consist of campuses and sites that manage their own facilities and operate under different circumstances, an agency may have these campus or sub-agency level organizations develop metering plans that best address their individual needs and modes of operation. If campus specific plans are developed they should be incorporated in the agency metering plan.

The agency metering plan should inventory buildings based upon whether standard or advanced meters will be utilized. The total square footage of space to be targeted for standard meters must be determined, in addition to the space targeted for advanced meters. Agencies will be required to report on the progress of installation against these total square footage values.

The agency metering plan should include, as an appendix, a list of buildings that have been identified for having advanced electrical metering installed. Each building listed shall include the site name, location, building square footage, and function/type.

The agency metering plan shall address how campuses and/or sites will finance the design, procurement, and installation of metering system hardware and software. While it will be helpful to have an estimated resource requirement up-front, agencies will likely have to base the financing plan on a general estimate, evaluate the various funding options available, and develop a financing portfolio.

The agency metering plan shall also include a metering implementation time line for each building or campus. The time line should be based on the percent goals of the agency building square footage inventory to be completed and/or percentage of cumulative electric load to be metered across the agency. Consider incorporating the buildings and/or installations into the time line on a priority or greatest payback basis, which is most often dictated by largest square footage.

## **TECHNICAL REQUIREMENTS AND CONSIDERATIONS**

Agencies should consider and establish several technical details when developing metering plans. First, the level of data metering should be established. There are four levels of metering:

- One-time/spot measurements (system/sub-system)
- Run-time measurements (system/sub-system)
- Short-term monitoring (system/sub-system/ whole building)
- Long-term monitoring (system/whole building)

The FEMP metering guidance document discusses these levels in further detail.

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The level of metering desired will help to establish the technical requirements of the meters required. However, within various meter types there are numerous features to choose from. Agencies are strongly recommended to obtain as much information on metering as possible prior to establishing detailed specifications. Suggested informational sources include first-hand research of metering vendors, Federal sites, or private sector businesses with existing metering programs, FEMP guidance and research, local utilities, and industry research.

When sufficient research has been completed, agencies should implement the following mechanisms:

### **A) Agency Design Guidance and Equipment Specifications**

Agencies should issue design guidance and equipment specifications to their components for metering program planning, equipment and hardware, and software and tools in support of USDA metering objectives. This guidance will assist agency sites with implementing metering programs and reduce the need for site personnel to reinvent these documents. The design guidance and equipment specification will serve as a template for individual sites, and will prevent a conflict between agency - level and site-level objectives.

### **B) Agency Metering System Communications Requirements**

Agencies should facilitate coordination between their facility managers and information technology staff regarding the metering system's communications requirements. Guidance should be provided on the types of communication tools to be used in various situations such as, energy management control systems (EMCS), networks, cellular devices, telephone/modem connections, or wireless components.

### **C) Metering Training**

Training of energy and facility personnel on advanced metering is critical to the successful installation and application of metering systems. As the metering planning requirement works its way to the site levels, many individuals not previously exposed to standard and/or advanced metering will be required to make informed decisions. Training individuals before critical decisions are made will ensure the systems eventually installed will not only satisfy the legislated requirement, but that the metering systems accomplish their desired objectives.

Agencies are encouraged to establish or arrange their own advanced metering training for site level personnel. Resources that may provide training include local utilities, metering vendors, and FEMP.

## **METHODS OF FINANCING**

Agencies should request funding in their annual budgets for this metering mandate as soon as possible.

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Beyond appropriated funds, a second option for funding, and perhaps the most realistic, is the use of alternative financing mechanisms, such as Energy Savings Performance Contracts (ESPC) and Utility Energy Services Contracts (UESC). Agency sites may include metering systems in a bundle of energy efficiency measures to be completed through an ESPC or UESC. Other options are available and have been outlined in the following table from the FEMP *Guidance for Electrical Metering in Federal Buildings*.

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**Summary of Potential Metering/Submetering Funding Mechanisms Available to Federal Sites and Agencies**

<b>Funding Mechanisms</b>	<b>Description</b>	<b>Advantages</b>	<b>Disadvantages</b>
Agency Appropriations	Fund using agency appropriations. Most likely local funding but funding can be designated as dedicated at headquarters level. Metering must compete against other initiatives for funding.	Traditional funding approach – no surprises. Potential use of utility funds may provide some local flexibility.	Funds tend to be very limited.
Retained Energy Savings	Agencies with statutory authority are permitted to retain and reinvest a portion of the savings in additional efficiency initiatives. (Section 102 EAct 2005)	Competition limited to other efficiency measures.	Retained energy savings are not widely applied. Check with your agency on its policy.
Energy Savings Performance Contracting (ESPC)	ESPCs may offer several approaches that support or promote the installation of advanced metering systems: – Install as part of measurement and verification effort – Install meters as an energy conservation measure – Purchase meters using a portion of the realized project savings – Install as an energy conservation measure with resulting savings realized stipulated	In cases where ESPCs are in place, new delivery orders can be placed and/or savings streams tapped. Advanced metering systems make possible several new energy conservation of measures such as real time purchasing, peak load management, and on-going retro commissioning. Measurement and verification will be much more rigorous and reliable than other M&V methods.	Meters for M&V may affect cost-effectiveness of measures. Likely reluctance to allow for stipulated savings resulting from installation of meters. More data (case studies) needed. True cost of meters now includes interest payments over the life of the contract.
Utility Energy Services Contracts (UESC)	UESCs have been widely used to install or update new facility mechanical/electrical systems.	UESC approach used widely across the federal sector. Investment paid back through utility bills.	Subject to availability on individual utility basis. Site should work to ensure that savings will result so that utility bill does not increase over budgeted amount. True cost of meters now includes interest payments over the life of the contract.

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Funding Mechanisms	Description	Advantages	Disadvantages
Utility Company Financing	Under utility area wide contracts, utilities can offer federal sites a range of services offered to other customers. While service offerings will vary by utility, examples of potential services include: <ul style="list-style-type: none"> <li>– Assistance in designing a metering plan</li> <li>– Utility covers up-front cost to purchase and install with repayment included as a fixed facility charge on bill for a set number of years</li> <li>– Subscription services where customer pays a fee for information but does not own, operate, or maintain metering equipment.</li> </ul>	Utility services are frequently offered by utilities to all customers in their service territory. Federal sites should tap into this pool of services when advantageous.	Services may not be offered by local utility.
Bonneville Power Administration (BPA)	For several years BPA has been working with federal sites to provide low-interest financing in support of energy efficiency measures. Requests for funding are bundled together allowing BPA to shop for the best available interest rates.	Performance guarantees not required in this approach.	Non-traditional funding approach. True cost of meters now includes interest payments over the life of the contract agreement.
Public benefits programs and utility demand response programs	States and/or utility service areas with potential electrical capacity problems may make funding available that allows customers to participate in programs where they can better manage loads.	Funds are “free” when qualifications are satisfied.	Only a limited number of states and utilities currently offer financial incentives to install advanced metering systems. <sup>a</sup> Funding will likely cover only a portion of the purchase cost of the meters—additional funding will still be required.
Require as part of new building and major renovations projects	This approach relies on establishing policy that requires installation of meters/submeters as part of major capital projects.	Cost to purchase and install is absorbed as part of the overall construction cost.	Ensuring requirement is not “value engineered out.”



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Funding Mechanisms	Description	Advantages	Disadvantages
Mandatory tenant submetering fees	Initiate a policy where tenants are billed the costs to purchase, install, and operate a metering/submetering system for their assigned facilities.	The approach assigns the cost to the party that can most benefit in terms of accurate billing and more efficient systems operations.	Tenants will protest additional cost, especially if they don't see benefit.
O&M Performance Incentives	Federal Acquisition Regulations (FAR), Subpart 16-404 Fixed Price with Award Fees, allows for contractors to receive a portion of savings realized from actions initiated on their part that are seen as additional to original contract. O&M performance incentives attempt to capitalize on this provision by awarding fees for contractors completing low-cost and no-cost measures not specifically called out in the contract. Contractor fee would be a part of the energy savings realized. Contractor can install advanced meters and use data to optimize buildings to achieve award eligible savings. <sup>b</sup>	Can be a no-cost approach to install meters as contractor may agree to pick-up purchase, installation, and operations costs.	There are no known examples of O&M performance incentives in federal buildings. Agreeing to terms with the O&M contractor may require significant negotiation. Performance incentives awards requires on-going oversight.
Lease Metering Equipment	Lease advanced meters from GSA Federal Supply Service similar to leasing of other equipment.	Can pay out of utility account so savings can cover lease payments. Less up-front funding needed.	Periodic leasing fees vs. one-time expense when purchasing.
<p>a. Information on state energy efficiency funds and demand response programs is available on the FEMP utility Web site: <a href="http://www.eere.energy.gov/femp/program/utility/utilityman_energymanage.cfm">http://www.eere.energy.gov/femp/program/utility/utilityman_energymanage.cfm</a>. Check with your state energy office and servicing utilities to verify and/or obtain information on current program offerings.</p> <p>b. See Section 3.8.1, Contract Language, of the FEMP O&amp;M Best Practices Guide for more information on O&amp;M performance incentives.</p>			

## **U.S. Department of Agriculture Guidance on Electric Metering PERFORMANCE MEASUREMENTS AND REPORTING**

In order to ensure progress toward the goals of the USDA Metering Policy and EPA Act 2005, Agencies are required to report on metering installation per the following outline.

**A) Agency Annual Energy Report and Implementation Plan**

Starting in FY 2007 and continuing through FY 2012, Agencies must complete the table below and include it in the agency Annual Energy Report. Projected metering activity should be included in the Agency Annual Implementation Plan. Agencies shall report the number of buildings metered (accompanied by a list of specific buildings), the cumulative square footage, and the percentage of agency electricity consumption represented by those buildings, and distinguish between standard meters and advanced meters for each year. The FY 2007 report should include the total number of buildings already being metered. All reporting should be on a cumulative basis. Also, agencies should include in their reports updated information to the list of buildings, such as, new building acquisitions.

FY	Standard Meters (where cost effective and/or practicable)		Advanced Meters (where cost effective and/or practicable)	
	Cumulative Square Footage of Buildings Metered	Cumulative % of Electric Metered	Cumulative Square Footage of Buildings Metered	Cumulative % of Electric Metered
2007				
2008				
2009				
2010				
2011				
2012				

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Agencies must determine which buildings will employ standard metering techniques and which will have advanced meters installed and develop an inventory baseline. These baselines will provide the basis to determine the percentages in the above table.

### **B) OMB Energy Scorecard**

The OMB Energy Scorecard includes electrical metering as a scored item. Updates to the scorecard are required bi-annually and therefore; USDA agencies may be required to provide an update during June of each year.

### **C) Review of Agency Metering Plans**

Agencies shall review and update metering plans annually to reflect changing electric rates, screening assumptions, lessons learned, design, financing, or procurement changes with the agency or at a specific site. Agency metering plans shall be reviewed and updated by September 30<sup>th</sup> of each year.

## **OUTREACH AND AWARENESS**

Agencies are encouraged to identify relevant metering system initiatives and projects under their respective cognizance as nominees for the various annual energy-related awards programs, such as, Federal Energy Management Awards, Presidential Energy Management Leadership Awards, and Closing the Circle Awards.

## **APPENDICES**

### **A1. Glossary of Electric Metering Terms**

- **Advanced Meters** – are those that have the capability to measure and record interval data (at least hourly for electricity), and communicate the data to a remote location in a format that can be easily integrated into an advanced metering system. EPCAct2005 Section 103 requires at least daily data collection capability.
- **Advanced Metering Device** - a separate electronic device coupled to a standard meter that enables it to function as and meet the definition of an advanced meter.
- **Advanced Metering Infrastructure** – The communications hardware and software and associated system and data management software that creates a network between advanced meters and utility business systems which allows collection and distribution of information to users.

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- **Advanced Metering Systems** – A system that collects time-differentiated energy usage data from advanced meters via a network system on either an on-request or defined schedule basis. The system is capable of providing usage information on at least a daily basis and can support desired features and functionality related to energy use management, procurement, and operations.
- **Automated Meter Reading (AMR)** – A system where aggregated kilowatt-hour usage, and in some cases demand, is retrieved via automated means such as a drive-by-vehicle, or walk-by-hand-held system.
- **Critical Peak Pricing** – A type of dynamic pricing whereby the majority of kilowatt-hour usage is priced on a time-of-use (TOU) basis, but where certain hours on certain days where the system is experiencing high peak demand are subject to higher hourly energy prices that reflect market conditions for peak generation and delivery during peak demand periods. These critical period prices may be known to electricity customers under conditions such as “day-ahead” or “hour-ahead” and are typically employed a limited number of times per year.
- **Demand Response** – Refers to the reduction of customer energy usage at times of peak usage in order to help address system reliability, reflect market conditions and pricing, and support infrastructure optimization or deferral. Demand response programs may include dynamic pricing/tariffs, price-response demand bidding, contractually obligated and voluntary curtailment, and direct load control/cycling.
- **Direct Load Control** - A system or program that allows utilities, other load serving entities, or demand response service providers to control user load via (1) direct cycling discretionary load of certain end users, (2) directly turning off such loads or (3) implementing custom load control strategies that reduce peak usage.
- **Dynamic Pricing** – Retail prices for energy consumed that offer different prices during different time periods and reflect the fact that power generation costs and wholesale power purchase costs vary during different time periods. Types include Time-of-Use Pricing, Critical Peak Pricing and Real-Time Pricing.
- **Economic Demand Response Programs** – Programs, which encourage demand reductions via price signals to energy users that reflect the higher costs of electricity production and delivery at times of system peak.

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- **Economic Demand Response Programs** – Programs which are dispatched by system operators when system operating reserves drop to levels such that load reductions are needed to maintain short-term system reliability.
- **Interval Meter** – A meter that measures and records kilowatt-hour usage on either predetermined or remotely configurable time intervals, where the intervals are in increments such as minutes or hours.
- **Load Management** – A term used to refer to interruptible rates, curtailment programs and direct load control programs.
- **Real-Time Pricing** – Energy prices that are set for a specific time period on an advanced or forward basis and that may change according to price changes in the generation spot market. Prices paid for energy consumed during these periods are typically established and known to consumers a day ahead (“day-ahead pricing”) or an hour ahead (“hour-ahead pricing”) in advance of such consumption, allowing them to vary their demand and usage in response to such prices and manage their energy costs by shifting usage to a lower cost period, or reducing consumption overall.
- **Retrofitted Meter** – A standard meter that has had an advanced metering device added to it.
- **Smart Meter** – Another term used to refer to an advanced meter.
- **Standard Meter** – Electromechanical or solid-state meters that cumulatively measure, record and store aggregated kilowatt-hour data that is periodically retrieved for use in customer billing or energy management. Meters that are not advanced meters are standard.
- **Time-of-Use Pricing** – Energy prices that are set for a specific time period on an advance or forward basis, typically not changing more often than twice a year (summer and winter season). Prices paid for energy consumed during these periods are pre-established and known to consumers in advanced of such consumption, allowing them to vary their demand and usage in response to such prices and manage their energy costs by shifting usage to a lower cost period, or reducing consumption overall. The time periods, which are pre-established, typically, include from two to four periods per day, and do not vary in start or stop times.